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CATALOGUE OF SPECIMENS  
OF THE  
MINERAL AND AGRICULTURAL PRODUCTS  
FROM THE LINE OF THE  
PHILADELPHIA AND READING RAILROAD,  
OF  
RAILS, &C. MANUFACTURED AT THE PHILADELPHIA AND  
READING RAILROAD ROLLING-MILL,  
AND OF  
MODELS OF BRIDGES IN USE ON THE LINE,  
EXHIBITED AT THE  
U. S. CENTENNIAL EXHIBITION,  
PHILADELPHIA, 1876.

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PHILADELPHIA :  
ALLEN, LANE & SCOTT'S PRINTING HOUSE,  
No. 233 South Fifth Street.  
1876.

# PHILADELPHIA AND READING RAILROAD CO.

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*President,*

FRANKLIN B. GOWEN.

*Managers:*

H. PRATT McKEAN,  
A. E. BORIE,  
J. B. LIPPINCOTT,  
JOHN ASHHURST,  
CHARLES E. SMITH,  
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OFFICE, No. 227 SOUTH FOURTH STREET, PHILADELPHIA.

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## THE EXHIBITS

OF THE

## PHILADELPHIA AND READING RAILROAD

ARE ARRANGED IN THE

Main Exhibition Building.....	Section T 72.
“       “       “ .....	West Gallery.
“       “       “   Mineral Annex.....	Y 56.
Machinery Hall.....	D 7.
United States Building.....	at intersection of Centre Avenues.



EXHIBITED IN MAIN BUILDING.

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PHILADELPHIA AND READING RAILROAD.

---

ROLLING-MILL.

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Exhibit  
marked

- No. 1.—Pile of old rails and puddled bar, to be rolled into bars  $4\frac{1}{2}$  in. x 1 in. and 3 in. x 1 in., as shown in body of rail-pile, marked No. 4.
- No. 2.—Pile of cold-short fine-grained puddled bars, to be rolled into bars  $4\frac{1}{2}$  in. x 1 in. and 3 in. x 1 in., as shown in pile marked No. 3.
- No. 3.—Pile to be rolled on edge or vertically in head bars, 9 in. x 2 in., as seen at top of pile marked No. 4.
- No. 4.—Pile to be rolled into a bloom, as shown in bloom marked No. 5.
- No. 6.—Bloom to be charged hot into a reheating furnace, wash-heated and rolled into a rail like that marked No. 6.
- No. 6.—Standard pattern of RAIL,  $4\frac{1}{2}$  inches high, weighing 68 pounds per yard, rolled into 24 feet lengths.
- No. 7.—Method of splicing 68-pound rail.
- No. 8.—Rail, 68 pounds to yard, twisted cold.

Exhibit  
marked

- No. 9.—RAIL, 68 pounds to yard.
- No. 10.—Old rail, 64 pounds to yard, placed in track January, 1870. Removed from track April, 1876. Has carried 56,300,000 tons of traffic. The original form of this rail is shown in No. 11.
- No. 11.—RAIL, 64 pounds to yard.
- No. 12.—PUNCHES and DIES made from Midvale steel, at the Philadelphia and Reading Rolling-mill.
- No. 13.—SPLICE-PLATE for 68-pound rail.
- No. 14.—RAIL, 56 pounds to yard.
- No. 15.—SPLICE-PLATE for 56-pound rail.
- No. 16.—Solid steel rail, rolled at Philadelphia and Reading Rolling-mill, from Siemens-Martin steel, made at Midvale Steel-works, at Philadelphia, Pa.
- No. 17.—STEEL-HEADED RAIL (Coxe's patent).
- No. 18.—STEEL-HEADED RAIL (Coxe's patent).
- No. 19.—Old rail (No. 10), 64 pounds to yard, placed in track January, 1870; removed from track April, 1876; has carried 56,300,000 tons of traffic. Twisted cold. The original form of this rail is shown in Exhibit No. 11.\*

The Philadelphia and Reading Railroad Company's ROLLING-MILL at Reading, Pennsylvania, was built in 1867. The first rail was rolled in March, 1868, and the product since that time to June 1st, 1876, has been iron and steel rails, and splice-plates; the capacity being 20,000 tons per annum, and the average yield 17,000 tons. The building is 90 feet span, 30 feet to the square. The main building is 420 feet long, to which are attached two wings, one 180 feet, the other 90 feet long. A trestle on the

\* Analysis of Rail:—

Phosphorus.....	0.422
Sulphur.....	0.032
Silica.....	0.392
Manganese.....	0.164
Carbon.....	0.027
Iron.....	98.963

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north side receives all the materials, such as coal, pig iron, old rails, sand, soapstone, fire-bricks, clay, ore, &c. used in the manufacture of the new rails, and the finished product is delivered to the cars on a sunken track at the south side of the mill.

The works consist of 12 single puddling-furnaces, with one plain cylinder boiler 36 inches by 30 feet over each; 8 heating and 2 re-heating furnaces, with two plain cylinder boilers 36 inches by 30 feet over each; one supplementary locomotive boiler; three vertical engines, with 40-inch by 40-inch cylinder, and fly-wheels 30 feet in diameter, weighing 70,000 pounds each, driving the 23-inch roll-trains; one puddle-train of rolls, two sets, three high, 23-inch diameter rolls, to which is attached a rotary squeezer; one train, three sets, three high, 23-inch diameter rolls; one set for breaking down old rails and puddled bar, one set for covers or head bars, and one set for blooming the rail pile; one train, one set, two high (with arrangement for three high), 23-inch diameter rolls, for finishing the rails; one train, one set, three high, 12-inch rolls, for rolling crop ends of rails, splice-plates, &c.; one horizontal engine, 24-inch by 30-inch cylinder, for driving the 12-inch rolls, two blast fans, two circular saws, friction rollers, rail-elevator, straightening-machine, two punching-machines, rail drill, and hot shears; one steam old-rail shears; two steam hot shears. Injectors are used for feeding boilers with water. In close proximity to the mill is a building 60 feet by 100 feet, containing a carpenter and pattern shop, blacksmith-shop, and machine-shop; in the latter is an engine with cylinder 10 inches by 24 inches driven by spare steam taken from the mill boilers. This engine drives a roll-turning lathe, two lathes, drill, planer, and fan.

In the rolling-mill the heating of the iron is done with anthracite coal; the puddling with anthracite coal or a mixture of anthracite coal dust and bituminous coal.



## COAL

### FROM PHILADELPHIA AND READING COAL AND IRON COMPANY.

SAMPLES FROM EACH BENCH OF EACH VEIN MINED AT AND  
NEAR THE ELLANGOWAN COLLIERY (No. 211), ARRANGED  
IN SECTION SO AS TO REPRESENT THEIR RELATIVE POSI-  
TIONS.

No. of Benches.							Total Thickness.	
							Feet.	Inches.
1.	Little Tracy Vein,	.	.	.	.	.	4	6
2.	Big Tracy Vein,	.	.	.	.	.	7	2
2.	Diamond Vein,	.	.	.	.	.	11	6
2.	Orchard Vein,	.	.	.	.	.	8	10
3.	Primrose Vein,	.	.	.	.	.	13	9
4.	Mammoth Vein—Top member,	.	.	.	.	13	0	
2.	“ Middle member,	.	.	.	.	8	6	
3.	“ Bottom member,	.	.	.	.	16	0	
							<hr/>	
	Total thickness,	.	.	.	.	.	37	6
1.	Skidmore Vein,	.	.	.	.	.	4	0
3.	Seven-foot Vein,	.	.	.	.	.	7	0
1.	Buck Mountain Vein,	.	.	.	.	.	13	0
							<hr/>	
	Total thickness of coal,	.	.	.	.	.	107	3

GEOLOGICAL SECTION (drawing), near Ellangowan Colliery,  
Schuylkill county, Pennsylvania. Scale, twenty feet to one inch.



## COAL

FROM PHILADELPHIA AND READING COAL AND  
IRON COMPANY.

Exhibit marked				Thickness.	
				Feet.	Inches.
2431. Little Tracy Vein—					
	From Ellangowan Colliery,	.	.	4	6
2432. Big Tracy Vein—					
	From Ellangowan Colliery,	.	.	7	2
2433. Diamond Vein—					
	From Ellangowan Colliery,	.	.	11	6
2434. Orchard Vein—					
	From Ellangowan Colliery,	.	.	8	10
2435. Primrose Vein—					
	From Knickerbocker Colliery,	.	.	13	9
2436. Mammoth Vein—					
	From Ellangowan Colliery,	.	.	37	6
2437. Skidmore Vein—					
	From North Mahanoy Colliery,	.	.	4	0
2438. Seven-foot Vein—					
	From North Mahanoy Colliery,	.	.	7	0
2439. Buck Mountain Vein—					
	From West Shenandoah Colliery,	.	.	13	0

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ORES.

## MAIN LINE.

Exhibit  
marked

1781. Red micaceous iron-ore, from near Douglassville, T. W. Ludwig.
- 2136 to 2145. Copper and zinc ores from W. H. Bines, Pottstown.
2147. James Gilbert's farm, near Pottstown, estimated yield, eight per cent. copper.
2148. Near Schwenksville, owned by Philadelphians; farmed by Philip Fox; yield not known; not worked since the Revolution. Copper.
2149. Near Schwenksville, owned by Philadelphians; farmed by Philip Fox; yield not known; not worked since the Revolution. Copper.
2156. Mr. Reikert's farm, Shannonville, Montgomery county, yield not known. Copper.
2158. Mr. Reikert's farm, Shannonville, Montgomery county, yield not known. Copper.
2165. Mr. Reikert's farm, Shannonville, Montgomery county, yield not known. Copper.

## LEBANON VALLEY BRANCH.

- 2100 to 2122. Iron ores, CORNWALL ORE-BANK COMPANY, Lebanon, Pa.
2123. Magnetic iron-ore, CORNWALL ORE-BANK COMPANY, Lebanon, Pa.
2146. Carbonate copper, CORNWALL ORE-BANK COMPANY, estimated yield, twenty per cent.

## CATAWISSA AND WILLIAMSPORT BRANCH.

2124. Fossil or soft ore, Waterman & Beaver, Pennsylvania Iron Works, Danville, Montour county, Pa.
2125. Block ore, Waterman & Beaver, Danville, Montour county, Pa.

Exhibit  
marked

2128. Fossil or limestone ore, Waterman & Beaver, Pennsylvania Iron Works, Danville, Pa.  
2129. Fossil or soft ore, Waterman & Beaver, Pennsylvania Iron Works, Danville, Pa.  
2130. Fossil or limestone ore, Waterman & Beaver, Pennsylvania Iron Works, Danville, Pa.  
2132. Limestone ore, A. T. Russell, Valley township, Montour county, Pa.  
2155. Limestone ore, A. T. Russell, Valley township, Montour county, Pa.  
2167. Limestone ore, A. T. Russell, Valley township, Montour county, Pa.

#### EAST PENNSYLVANIA BRANCH.

1156. Seasholtzville iron-ore (hard white).  
1157. Seasholtzville iron-ore (dark blue).  
1158. Seasholtzville iron-ore (brown).  
2126. Iron-ore, Alburtis.  
2127. Iron-ore, Alburtis.  
2133. Hematite ore, Charles Puell, two miles from Temple station.  
2134. Hematite ore, Charles Puell, two miles from Temple station.  
2135. Hematite ore, Charles Puell, two miles from Temple station.  
2154. Iron pyrites, T. C. Breinig, Breinig's Mines, Breinigsville, Lehigh county, Pa.  
2157. Iron-ore, T. C. Breinig's Mines, Breinigsville, Lehigh county.  
2160. Iron-ore, T. C. Breinig's Mines, Breinigsville, Lehigh county.  
2162. Iron-ore, T. C. Breinig's Mines, Breinigsville, Lehigh county.

#### READING AND COLUMBIA RAILROAD.

2450. Iron-ore from CONOWINGO.



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CORNWALL ORE-BANKS.

“Four or five miles from Lebanon rise three ore-hills, representing together an oval, 400 feet long at each end and 800 feet at its greatest diameter. This oval is cut by ravines into the three hills mentioned,—one, the East Hill, the so-called ‘Big Hill,’ 300 feet high; the Middle Hill, 100 feet high, and the Grassy Hill, 70 to 80 feet high. This is a mass of almost pure iron-ore, magnetic, regularly stratified, and almost horizontal. This mass is walled about by ridges of eruptive doleretic rock or trap.”

“To determine the extent of the deposit, borings have been made by the diamond-drill in the Middle Hill to the depth of 300 feet, 200 feet below the water level, and the bottom of the deposit was not reached. Remembering that the Big Hill is 300 feet high, we shall have a mass of iron at least 500 feet in vertical thickness in this hill.”

“This ore is comparatively soft, with little phosphorus, of a granular nature, associated with copper and a little cobalt. It seems well adapted for Bessemer metal, and 25 per cent. is used at the Bessemer Steel Works, at Harrisburg, Pa.”

Cornwall has long been the seat of iron manufacture. The famous charcoal-furnace, still in blast and the oldest in existence, has supplied the iron trade for years, and established a reputation for Cornwall iron which has grown with the years, until to-day it is regarded as the best brand made by any of the charcoal-furnaces in the country. This furnace supplied the iron for the cannon and ball made in the days of the Revolution.

The deposits of iron ore at DILLSBURG and its vicinity belong to the same geological horizon and are closely related to Cornwall, in mineralogical association.

The ores found at WHEATFIELD and BOYERTOWN are similar to those of Cornwall. At BOYERTOWN there is found, at a depth of 300 feet, a bed of magnetic ore nearly 200 feet in thickness. Magnetic ore is also found in quantity at the JONES MINE, between Morgantown and Springfield, in Caernarvon township, Berks county.





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## LIMESTONES.

### MAIN LINE.

Exhibit  
marked

2055. T. C. Zulick, Schuylkill Haven.

### LEBANON VALLEY BRANCH.

- 2032. Binkley & Co., Wernersville.
- 2033. Binkley & Co., Wernersville.
- 2036. J. S. Wagner, Lebanon.
- 2037. J. S. Wagner, Lebanon.
- 2038. J. S. Wagner, Lebanon.
- 2040. Stephen A. Denner, Wernersville.
- 2041. Cyrus Sherk, Myerstown.
- 2042. Cyrus Sherk, Myerstown.
- 2043. Cyrus Sherk, Myerstown.
- 2044. Cyrus Sherk, Myerstown.
- 2045. S. J. Seibert, Richland.
- 2046. S. J. Seibert, Richland.
- 2047. William Beaver, Annville.
- 2049. D. M. Karmany, Lebanon.
- 2051. John A. Rutherford, Paxton station.
- 2053. Kaufman & Co., Swatara.
- 2054. C. E. Metzler, Palmyra.
- 2057. S. W. Clay, Richland.
- 2061. P. & R. Cut, Harrisburg.
- 2063. J. W. Deppen, Wernersville.
- 2064. J. W. Deppen, Wernersville.
- 2066. Daniel Heisey, North Annville.
- 2067. Daniel Heisey, North Annville.
- 2068. Peter Fry, Hummelstown.
- 2072. Daniel Beaver, North Annville.
- 2185. Danner & Hamlin, Sinking Spring.
- 2186. Schrack & Ruth, Sinking Spring.

## LIMESTONES.

### GERMANTOWN AND NORRISTOWN BRANCH.

Exhibit  
marked

- 2034. Shronk & Earnest, near Potts' Landing.
- 2059. Yeakle & Brother, Flourtown.
- 2069. Yeakle & Brother, Flourtown.
- 2056. Boyd & Co., East Conshohocken.
- 2065. J. K. Graver, Plymouth Quarry.
- 2071. Williams Quarry, Williams station.

### CHESTER VALLEY BRANCH.

- 2031. William Rennyson, Howellville.
- 2035. J. T. & H. McInnes, McInnes siding.
- 2048. Knickerbocker Lime Company, Mill lane.
- 2050. Peter Tarter, Howellville.
- 2070. Cedar Hollow Lime Company.

### SCHUYLKILL AND SUSQUEHANNA BRANCH.

- 2058. John Light, Pinegrove.

### EAST PENNSYLVANIA BRANCH.

- 2062. Mertztown.

### CATAWISSA AND WILLIAMSPORT BRANCH.

- 2131. Waterman & Beaver, Montour county, Pa.

## SANDSTONE.

### MAIN LINE.

Exhibit  
marked

- 2181. Ludwig & Mauger, Douglassville.
- 2187. Ludwig & Mauger, Douglassville.
- 2188. Conglomerate, Neversink station.

### CATAWISSA AND WILLIAMSPORT BRANCH.

- 2174. John F. Fortwer, Catawissa.
- 2176. A. O. Jacoby, near Beaver Valley station.
- 2177. A. O. Jacoby, near Beaver Valley station.
- 2178. D. P. Guise's Quarry, Williamsport.
- 2179. William T. Shuman, Nescopec mountain, near Mainville.
- 2180. Pennsylvania Brown Freestone Quarries, Hummelstown.

### SCHUYLKILL AND SUSQUEHANNA BRANCH.

- 2184. Steinbach's Quarry.



## MARBLE.

### LEBANON VALLEY BRANCH.

- 2073. William Beaver, Annville, Lebanon county.



## MISCELLANEOUS.

Exhibit  
marked

2188. Conglomerate—Neversink station, Main Line.  
 2465. Graphite — Pickering Valley Branch, Pennsylvania  
 Graphite Mining and Manufacturing Company.  
 1782. Kaolin, white, thirty feet thick, from Oley township,  
 Berks county, Ludwig & Mauger.  
 1783. Kaolin, yellow, Ludwig & Mauger.  
 1788. Plate made from Kaolin No. 1782.  
 1789. Tile made from Kaolin No. 1782.  
 1785. Paper clayed with No. 1782, white, 18%.  
 1787. Paper clayed with No. 1783, buff, 17%.

Large manufactories of paper from wood, straw, and other materials are located at Manayunk, Royer's Ford, and Reading, on the Main Line of the Philadelphia and Reading Railroad.

PIG IRON, made at the Ringgold, St. Clair, and East Penn furnaces, on the line of the Philadelphia and Reading Railroad, from a mixture of

- $\frac{3}{6}$  Cumberland ore, Pennsylvania.  
 $\frac{1}{6}$  Seasholtzville ore, “  
 $\frac{1}{6}$  West Point ore, New York.  
 $\frac{1}{6}$  Port Henry ore, “

The samples are marked,

- Ringgold, Nos. 1, 2, 3, 4, 5.  
 St. Clair, “ 1, 2, 3, 4, 5.  
 East Penn, “ 1, 2, 3, 4.

The No. 3 irons, when puddled and rolled into bars, show a tensile strength of 60,000 pounds per square inch.

PIG IRON, from W. M. Kaufman & Co., Sheridan furnace, 2 samples.

## CEREALS.

## MAIN LINE.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1800.	JOHN SUPPLEE, Swede Furnace, Montgomery county.....	37	64
1801.	CHARLES LATCH, Lower Merion township, Montgomery county	41	63
1802.	JACOB SCHWENK, Limerick township, Montgomery county....	...	61
1803.	Captain HARRY FETTEROLF, Upper Providence township, Montgomery county.....	30	66
1804.	BENJAMIN ABRAHAM, Upper Merion township, Montgomery county.....	....	63
1805.	BENEDICT LEEDOM, Lower Merion township, Montgomery county.....	40	62
1806.	JACOB HARTMAN, Philadelphia and Reading Farm, Hamburg, Berks county.....	25	60
1807.	ISRAEL MILLER, Union township, Berks county.....	27	64
1980.	ANDREW REBER, South Manheim township, Schuylkill county	35	62
1982.	DAVIS SAVAGE, East Coventry, Chester county.....	30	64

## CORN.

1808.	JOHN F. FRITZ, Pottsgrove township, Montgomery county....	100	58
1809.	DANIEL STAUFFER, Limerick township, Montgomery county..	....	....
1810.	GEORGE T. GROW, Lower Merion township, Montgomery county.....	70	56
1811.	CHARLES LATCH, Lower Merion township, Montgomery county	70	56
1812.	HARRY FETTEROLF, Upper Providence, Mingo Station, Mont- gomery county.....	89	58
1813.	BENJAMIN ABRAHAM, Upper Merion township, Montgomery county.....	....	56
1814.	BENEDICT LEEDOM, Lower Merion township, Montgomery county.....	60	56
1815.	JEREMIAH BOYER, Amity township, Berks county .....	55	57
1816.	WILLIAM K. MERCER, Albany township, Berks county.....	65	58
1816.	JACOB HARTMAN, Philadelphia and Reading Farm, Hamburg, Berks county.....	75	58
1969.	ANDREW REBER, South Manheim township, Schuylkill county	30	60
1970.	A. H. MILLER, North Manheim township, Schuylkill county..	48	59

Exhibit marked	Bushels per acre.	Pounds per bushel.
1973. DANIEL LOUGHIN, Port Kennedy, Montgomery county.....	....	....
2024. CHARLES LATCH, Lower Merion, Montgomery county.....	70	56

OATS.

1817. TRISTIAN SCHURR, Limerick township, Montgomery county....	....	33
1818. BENJAMIN ABRAHAM, Upper Merion township, Montgomery county.....	....	32
1819. JAMES BEAN, Upper Providence, Mingo Station, Montgomery county.....	60	40
1820. JACOB HARTMAN, Philadelphia and Reading Farm, Hamburg, Berks county.....	45	32
1821. JOHN D. HOLLOWAY, Amity township, Berks county.....	60	45
1822. JOHN B. HOLLOWAY, Amity township, Berks county.....	60	42
1827. BENEDICT LEEDOM, Lower Merion, Montgomery county.....	....	36
1990. ANDREW REBER, South Manheim township, Schuylkill county	55	35
1992. DAVIS SAVAGE, East Coventry township, Chester county.....	50	35

RYE.

1823. JACOB SCHWENK, Limerick township, Montgomery county....	....	58
1824. ABEL THOMAS, Upper Providence, Mingo Station, Montgomery county.....	....	60
1825. SAMUEL BOWMAN, Pottsgrove township, Montgomery county..	25	56½
1826. BENEDICT LEEDOM, Lower Merion, Montgomery county.....	....	56
1828. ISRAEL MILLER, Union township, Berks county..	25	57
1989. JOHN M. KAUFFMAN, South Manheim township, Schuylkill county .....	45	56



## CEREALS.

## CHESTER VALLEY BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1829. —	ASHBRIDGE, East Whiteland township, Chester county..	....	....
1830.	C. W. CHAMBERS, Oakland Station, Chester county.....	....	....
1831.	MORRIS THOMSON, East Caln, Chester county.....	....	..
1832.	WILLIAM W. DAVIS, Chester Valley, Chester county.....	20	60
1833.	JOHN CLARK, West Whiteland, Chester county.....	22	65
1834.	JOHN M. WILSON, Chester Valley, Chester county.....	18	62
1835.	RICHARD WHITE, Chester Valley, Chester county.....	....	....
1836.	DAVID HAVARD, Chester Valley, Chester county.....	22	60
1837.	JOHN F. ALDRED, East Caln, Chester county.....	....	....
1838.	JOHN AKINS, JR., East Whiteland, Chester county.....	16	64
1839.	JOSEPH DEWEES, near Centreville, Chester county.....	...	64
1840.	NATHAN GRIFFITH, Chester Valley, Chester county.....	25	63
1841.	PETER HARTMAN, Chester Valley, Chester county.....	18	60
1843.	SHOEMAKER & ROBINSON, East Whiteland, Chester county....	....	....
1844.	H. DOWNING, East Whiteland, Chester county.....	....	....
1847.	L. P. ROBINSON, East Whiteland, Chester county.....	....	....

## CORN.

1842.	W. W. DAVIS, Chester Valley, Chester county.....	72	60
1843.	ALBERT H. DAVIS, Chester Valley, Chester county.....	70	60
1844.	JOHN WILSON, Chester Valley Railroad, Chester county.....	60	56
1845.	DAVID HAVARD, Chester Valley, Chester county..	72½	60
1846.	M. D. CORNOG, Chester Valley, Chester county.....	80	60
1847.	THOMAS U. WALKER, near Centreville, Chester county.....	....	60
1848.	J. BURNETT, West Whiteland, Chester county.....	75	57
1849.	WILLIAM MEREDITH, East Whiteland township, Whiteland, Chester county.....	65	58
1850.	PETER HARTMAN, Chester Valley, Chester county.....	80	58
1851.	F. DOWNING, Chester county.....	60	54
1852.	JOHN HARRAR, East Whiteland, Chester county.....	75	56
1871.	RICHARD WHITE, East Whiteland, Chester county.....	....	...



Exhibit marked	Bushels per acre.	Pounds per bushel
1972. L. P. ROBINSON, East Whiteland, Chester county.....	....	....
1994. POTTS BROTHERS, East Caln township, Chester county.....	....	....
1979. DAVID SAVAGE, East Whiteland, Chester county.....	80	56
2010. F. DOWNING, Chester county.....	60	54

## OATS.

1853. MORRIS THOMSON, East Caln township, Chester county.....	....	....
1854. C. W. CHAMBERS, Oakland Station, Chester county.....	....	....
1855. WILLIAM MERDOETHE, Chester county.....	....	....
1856. DAVID HAVARD, Chester Valley, Chester county.....	60	30
1857. RICHARD WHITE, Chester Valley, Chester county.....	....	....
1858. JOHN M. WILSON, Chester Valley Railroad, Chester county...	25	28
1859. EVANS KENDALL, Centreville, Chester county.....	...	35
1860. JONATHAN ROBERTS, East Whiteland township, Chester county .....	40	32
1861. JOHN CLARK, West Whiteland township, Chester county.....	46	45
1862. PETER HARTMAN, Chester Valley, Chester county.....	35	32
1863. WILLIAM W. DAVIS, Chester Valley, Chester county.....	53½	26½
1993. SHOEMAKER & ROBINSON, East Whiteland township, Chester county .....	....	....
1994. HARVARD DOWNING, East Whiteland township, Chester county .....	....	..
1996. L. P. ROBINSON, East Whiteland township, Chester county....	....	....

## RYE.

1864. M. D. CORNOG, Chester Valley, Chester county.....	22	60
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## CEREALS.

## CATAWISSA AND WILLIAMSPORT BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1986.	ISAIAH KIRK, Montoursville, Lycoming county.....	36½	62
1997.	T. J. STREBEIGH, Montoursville, Lycoming county.....	22½	...
1999.	T. J. STREBEIGH, Montoursville, Lycoming county.....	...	...
2002.	EBENEZER WALTON, Muncy borough.....	28	56
2004.	S. SHICK, Port Clinton township.....	20	54
2005.	ABRAM TULE, Montoursville, Lycoming county.....	...	...

## CORN.

1976.	ISAIAH KIRK, Montoursville, Lycoming county.....	93	...
1977.	WILLIAM B. KUNKLE, Montoursville, Lycoming county.....	82	...
1978.	A. TULE, Montoursville, Lycoming county .. ..	80	...
2022.	JOHN BARE, Clinton, Lycoming county.....	80.	...
2025.	ISAIAH KIRK, Montoursville, Lycoming county.....	93	...

## OATS.

1998.	ABRAM TULE, Montoursville, Lycoming county.....	...	...
2003.	EDWARD WRIGHT, Hall's Station, Lycoming county.....	45	30

## RYE.

2001.	JOHN KITCHEN, Clinton township, Lycoming county.....	25	53
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## CEREALS.

## MAHANOEY AND SHAMOKIN BRANCH.

Exhibit marked	WHEAT.	Bushels	Pounds
		per acre.	per bushel.
1950.	CARR WILSON, Butler township, Schuylkill county.....	25	56
1951.	WILLIAM BOLICH, Taylorsville, Barry township, Schuylkill county .....	26	60
1952.	MRS. LYDIA YARNALD, Barry township, Schuylkill county...	25	56
1953.	WILLIAM BOLICH, Taylorsville, Barry township, Schuylkill county .....	...	54
1965.	GEORGE H. MALICH, Jackson township, Northumberland county .....	20	58

## CORN.

1954.	CARR WILSON, Butler township, Schuylkill county.....	80	60
1955.	C. G. REED, Barry township, Schuylkill county.....	75	56
1956.	NATHAN BOLICH, Barry township, Schuylkill county.....	80	60
1957.	SAMUEL HEPLER, Taylorsville, Barry township, Schuylkill county .....	75	58
1958.	WILLIAM BOLICH, Taylorsville, Barry township, Schuylkill county .....	70	56
1959.	LEVI HEEBLER, Barry township, Schuylkill county.....	80	60
1966.	GEORGE H. MALICH, Jackson township, Northumberland county .....	70	58

## OATS.

1960.	LEVI HEEBLER, Barry township, Schuylkill county.....	36	40
1961.	N. BOLICH, Barry township, Schuylkill county.....	35	36
1962.	CARR WILSON, Butler township, Schuylkill county.....	28	25
1967.	GEORGE H. MALICH, Jackson township, Northumberland county .....	25	36

## RYE.

1963.	NATHAN BOLICH, Barry township, Schuylkill county.....	30	60
1964.	LEVI HEEBLER, Barry township, Schuylkill county.....	28	56

## CEREALS.

## PICKERING VALLEY BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1865.	JOSEPH J. TUSTIN, West Pikeland, Chester county.....	30	63
1866.	JERMAN DICKINSON, Chester Springs, Chester county.....	30	64
1867.	JOSEPH BUTLER, Upper Uwchlan township.....	1874 33	65
		1875 10	63

## CORN.

1869.	JOSEPH BUTLER, Upper Uwchlan township, Chester county..	75	56
1870.	ISAAC TUSTIN, Chester Springs, Chester county.....	80	57
1871.	JERMAN DICKINSON, Chester Springs, Chester county.....	80	...
1872.	JOSEPH J. TUSTIN, West Pikeland, Chester county.....	75	56
1873.	ELIAS OBERHOLTZER, West Pikeland, Chester county.....	95	57
2014.	ELIAS OBERHOLTZER, West Pikeland, Chester county.....	95	57
2021.	ISAAC TUSTIN, Chester Springs, Chester county.....	80	57

## OATS.

1874.	JOSEPH BUTLER, Upper Uwchlan township, Chester county...	45	32
1875.	ISAAC HOLMAN, Chester Springs, Chester county.....	35	31
1968.	JOSEPH J. TUSTIN, West Pikeland, Chester county.....	35	32

## RYE.

1876.	ISAAC TUSTIN, Chester Springs, Chester county.....	25	59
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## CEREALS.

## SCHUYLKILL AND SUSQUEHANNA BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1916.	LONDON BOWEN, Pinegrove township, Schuylkill county.....	35	63
1917.	AARON STRUBENHAUER, Pinegrove township, Schuylkill county .....	35	63
1948.	DANIEL BOAR, Susquehanna township, Dauphin county.....	34	64
1981.	J. S. KELLER, West Brunswick, Schuylkill county.....	25	60
1985.	J. L. NUTTING, Brookside Farm, Pinegrove township, Schuyl- kill county.....	...	...

## CORN.

1928.	LONDON BOWEN, Pinegrove township, Schuylkill county.....	40	58
1919.	AARON STRUBENHAUER, Pinegrove township, Schuylkill county .....	35	58
1920.	GEORGE FELTY, Ellwood Station, Pinegrove township, Schuyl- kill county.....	50	57
1921.	J. B. SEIDEL & SONS, Ellwood Iron-works, Pinegrove town- ship, Schuylkill county.....	60	56
1922.	J. B. SEIDEL & SONS, Ellwood Iron-works, Pinegrove town- ship, Schuylkill county.....	50	57
1949.	ABRAHAM REAM, Susquehanna township, Dauphin county...	270	73
1975.	J. L. NUTTING, Brookside Farm, Pinegrove, Schuylkill county	...	...
2007.	J. B. SEIDEL & SONS, Ellwood Iron-works, Pinegrove town- ship, Schuylkill county.....	60	56
2015.	ABRAHAM REAM, Susquehanna township, Dauphin county...	270	...

## OATS.

1923.	LONDON BOWEN, Pinegrove township, Schuylkill county.....	55	38
1924.	GEORGE FELTY, Ellwood Station, Pinegrove township, Schuyl- kill county.....	30	...
1925.	AARON STRUBENHAUER, Pinegrove township, Schuylkill county .....	50	39
1926.	J. B. SEIDEL & SONS, Ellwood Iron-works, Schuylkill county..	36	33
1991.	J. S. KELLER, West Brunswick, Schuylkill county.....	45	40
1995.	J. L. NUTTING, Brookside Farm, Pinegrove, Schuylkill county,	...	...

Exhibit marked	RYE.	Bushels per acre.	Pounds per bushel.
1868.	AUGUSTUS & JOHN DEWALT, Stony Creek Valley, Dauphin county .....	30	64
1927.	LONDON BOWEN, Pinegrove township, Schuylkill county.....	38	59
1988.	J. S. KELLER, West Brunswick, Schuylkill county .....	45	56

CEREALS.

READING AND COLUMBIA RAILROAD.

Exhibit marked	WHEAT.	Bushels per acre.	Pounds per bushel.
1882.	JOHN S. HARMAN, Pequea township, Lancaster county.....	...	63.
1883.	ISAAC B. KAUFFMAN, Penn township, Lancaster county.....	63	30
1884.	CHRISTIAN LIPP, Pequea township, Lancaster county.....	...	64
1885.	JOHN HARNISH, Pequea township, Lancaster county.....	59	55

CORN.

1886.	E. B. BOMBERGER, Manheim Mills, Manheim, Lancaster county	75	57
1887.	CHRISTIAN C. LIPP, Pequea township, Lancaster county.....	80	58
1888.	JOHN HARNISH, Pequea township, Lancaster county.....	76	59
2016.	E. B. BOMBERGER, Manheim Mills, Manheim, Lancaster county .....	75	57

OATS.

1889.	JOSEPH WENGER, Rapho township, Lancaster county.....	50	31
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RYE.

1890.	FREDERICK FRICKER, Rapho township, Lancaster county.....	35	59
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## CEREALS.

## BERKS AND LEHIGH BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1928.	CHARLES E. KUTZ, Greenwich township, Berks county.....	28	60
1929.	SAMUEL K. FISHER, Windsor township, Berks county.....	35	63
1937.	JOSEPH GIFT, Lynn township, Lehigh county.....	30	68
1938.	DANIEL OSWALD, Lynnport, Lehigh county.....	28	62
1939.	WILLIAM ROTH, Slatedale, Lehigh county.....	30	63

## CORN.

1930.	CHARLES E. KUTZ, Greenwich township, Berks county.....	60	...
1931.	JOHN BARNHARD, Muhlenberg township, Berks county.....	88	60
1932.	AMOS HARTMAN, Muhlenberg township, Berks county.....	90	59
1940.	LEVI GREENAWALD, Lynn township, Lehigh county.....	65	...
1941.	JOSEPH GIFT, Lynn township, Lehigh county.....	70	.
1942.	DANIEL OSWALD, Lynnport, Lehigh county.....	75	60
2011.	DANIEL OSWALD, Lynnport, Lehigh county.....	75	60
2017.	JOSEPH GIFT, Lynn township, Lehigh county.....	70	...
2018.	AMOS HARTMAN, Muhlenberg township, Berks county.....	90	59

## OATS.

1933.	CHARLES E. KUTZ, Greenwich township, Berks county .....	55	38
1934.	SAMUEL K. FISHER, Windsor township, Berks county.....	45	32
1943.	LEVI GREENAWALD, Lynn township, Lehigh county.....	55	38
1944.	JOSEPH GIFT, Lynn township, Lehigh county.....	50	39
1945.	DANIEL OSWALD, Lynnport, Lehigh county.....	40	34

## RYE.

1935.	CHARLES E. KUTZ, Greenwich township, Berks county.....	25	56
1936.	DANIEL HEFFNER, Richmond township, Berks county.....	33	63
1946.	JOSEPH GIFT, Lynn township, Lehigh county.....	25	58
1967.	LEVI GREENAWALD, Lynn township, Lehigh county.....	25	57



## CEREALS.

## LEBANON VALLEY BRANCH.

Exhibit marked	WHEAT.	Bushels Pounds	
		per acre.	per bushel.
1891.	THOMAS B. REBER, Wernersville, Lower Heidelberg township, Berks county.....	35	62
1899.	WILLIAM H. SCHLAPPIG, Upper Bern township, Berks county	25	62
1893.	ISRAEL L. MILLER, Upper Bern township, Berks county.....	25	63
1894.	WILLIAM RENNO, Upper Bern township, Berks county.....	31	62
1896.	WILLIAM RENNO, Upper Bern township, Berks county.....	30	63
1895.	A. B. REBER, Upper Bern township (Philadelphia and Reading Farm), Berks county.....	28	61
1897.	ISAAC KETNER, Upper Bern township, Berks county.....	30	64
1907.	D. B. ULRICH, North Annville, Lebanon county.....	24	66

## CORN.

1898.	WILLIAM WAGNER, Upper Bern township, Berks county.....	80	56
1899.	ALFRED B. REBER, Upper Bern township (Philadelphia and Reading Farm), Berks county.....	....	56
1900.	WILLIAM H. SCHLAPPIG, Upper Bern township, Berks county..	65	56
1901.	WILLIAM RENNO, Upper Bern township, Berks county.....	80 to 85	56
1902.	JONATHAN KNORR, Lower Heidelberg township, Berks county,	85	57
1913.	JOSEPH REIDER, Annville, Lebanon county.....	98	75
1914.	CHARLES GREENAWALD, North Lebanon township, Lebanon county.....	64	58
1915.	HENRY HILLINGER, Londonderry township, Lebanon county..	85	...
2008.	CHARLES GREENAWALD, North Lebanon, Lebanon county....	64	58
2009.	ALFRED B. REBER, Upper Bern township, Berks county.....	...	56
2012.	JONATHAN KNORR, Lower Heidelberg township, Berks county.	85	57
2013.	WILLIAM RENNO, Upper Bern township, Berks county.....	80 to 85	56
2019.	HENRY HILLINGER, Londonderry township, Lebanon county..	85	...
2023	WILLIAM WAGNER, Upper Bern, Berks county.....	80	56

## OATS.

1903.	WILLIAM H. SCHLAPPIG, Upper Bern township, Berks county..	50	33
1904.	WILLIAM RENNO, Upper Bern township, Berks county.....	45	33
1905.	A. B. REBER, Upper Bern township, Berks county.....	50	32



Exhibit marked	RYE.	Bushels per acre.	Pounds per bushel.
1906.	MRS. ELIZABETH PEIFER, Lower Heidelberg township, Berks county.....	37	58

## CEREALS.

### PERKIOMEN BRANCH.

#### WHEAT.

1877.	WILLIAM M. ROEDER, Hosensack, Montgomery county.....	...	...
1878.	REUBEN M. ROEDER, Hosensack, Montgomery county.....	25	64

#### CORN.

1879.	REUBEN M. ROEDER, Hosensack Valley, Montgomery county..	80	58
2020.	REUBEN M. ROEDER, Hosensack Valley, Montgomery county..	80	58

#### OATS.

1880.	REUBEN M. ROEDER, Hosensack Valley, Montgomery county..	60	33
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#### RYE.

1881.	WILLIAM M. ROEDER, Hosensack Valley, Montgomery county..	...	...
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## CEREALS.

### LEBANON AND TREMONT BRANCH.

#### WHEAT.

Exhibit marked		Bushels per acre.	Pounds per bushel.
1908.	JOHN HEILMAN, Heilmandale, Lebanon county.....	25	64
1909.	JOHN HEILMAN, Heilmandale, Lebanon county.....	25	64
1910.	JOHN HEILMAN, Heilmandale, Lebanon county.....	30	65
1911.	JOHN HEILMAN, Heilmandale, Lebanon county.....	25	62
1912.	JOHN HEILMAN, Heilmandale, Lebanon county.....	22	63

NOTE.—The bushels per acre and pounds per bushel in the above table were furnished by the parties who contributed the samples of grain.

## EXHIBIT IN GOVERNMENT BUILDING.

## COAL.

## GEOLOGICAL SECTION.

The column of anthracite now standing in the Government Department of the Centennial Exhibition was taken from the Plank Ridge Mine, at a distance of about one hundred and sixty feet below the surface. The accompanying table gives in detail the components of the vein. It will be seen that the good coal very largely preponderates, being in the aggregate forty feet eleven inches thick; while the "bony coal" (which is an inferior quality of coal) is one foot eight inches thick, and the slate which, though often highly carbonized, is carefully separated from the coal in the preparation, is one foot five inches in thickness; making the total thickness of the vein forty-four feet. The "bony" coal and slate are largely used in raising of steam at the colliery, and very little other fuel is now burned.

No. of Bench.	Thickness.		DESCRIPTION.
	Feet.	Inches.	
TOP SLATE.			
19.	1	6	Coal hard and bright.
18.	1	8	Coal hard and bright.
17.	2	6	Coal hard and bright.
	0	4	Bony coal.
16.	1	7	Coal hard and bright.
	0	1	Slate.
15.	2	5	Coal hard and bright.
14.	2	0	Coal hard and bright.
	0	2	Bony coal.
13.	2	1	Coal hard and bright.

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No. of Bench.	Thickness. Feet. Inches.		DESCRIPTION.
	0	3	Bony coal.
12.	1	9	Coal hard and bright.
11.	2	0	Coal hard and bright.
	0	4	Bony coal.
10.	1	3	Coal hard and bright.
	0	3	Bony coal.
9.	2	2	Coal hard and bright.
8.	1	0	Slate.
7.	1	6	Coal bright and glassy.
6.	2	10	Coal very rough, is called the charcoal bench.
5.	5	0	Coal, the best bench in the vein.
4.	2	8	Coal hard, bright, and glassy.
	0	4	Slate.
3.	1	2	Coal hard, bright, and glassy.
	0	4	Bony coal.
2.	2	6	Coal hard, bright, and glassy.
1.	4	4	Coal hard, bright, and glassy.

BOTTOM SLATE.

Total thickness of vein 44 feet.

This column of coal stands in the centre of the United States Government Building.

PHILADELPHIA & READING COAL & IRON COMPANY

GEOLOGICAL SECTION

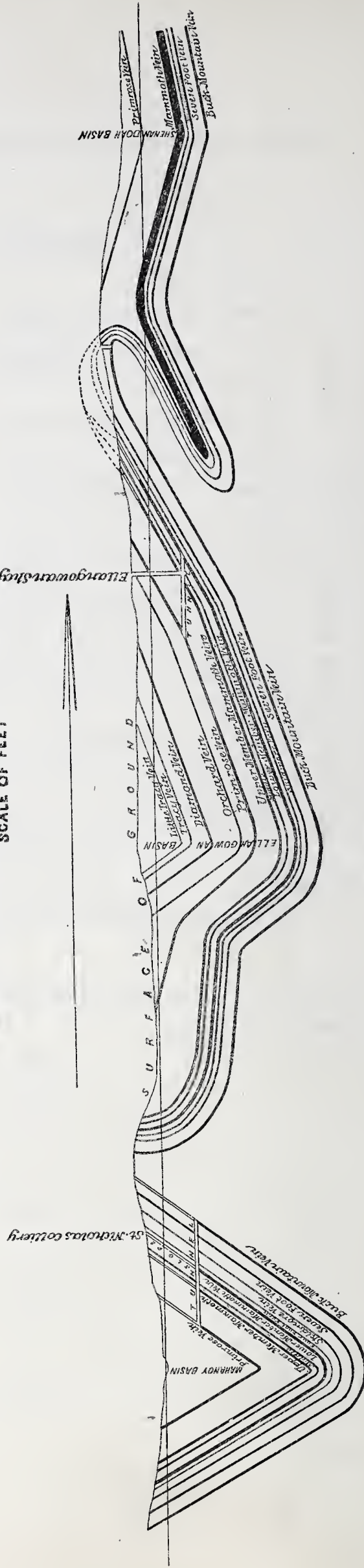
OF VEINS IN

Shenandoah, Ellangowan & Mahanoy Basins

Schuylkill County, Penna.

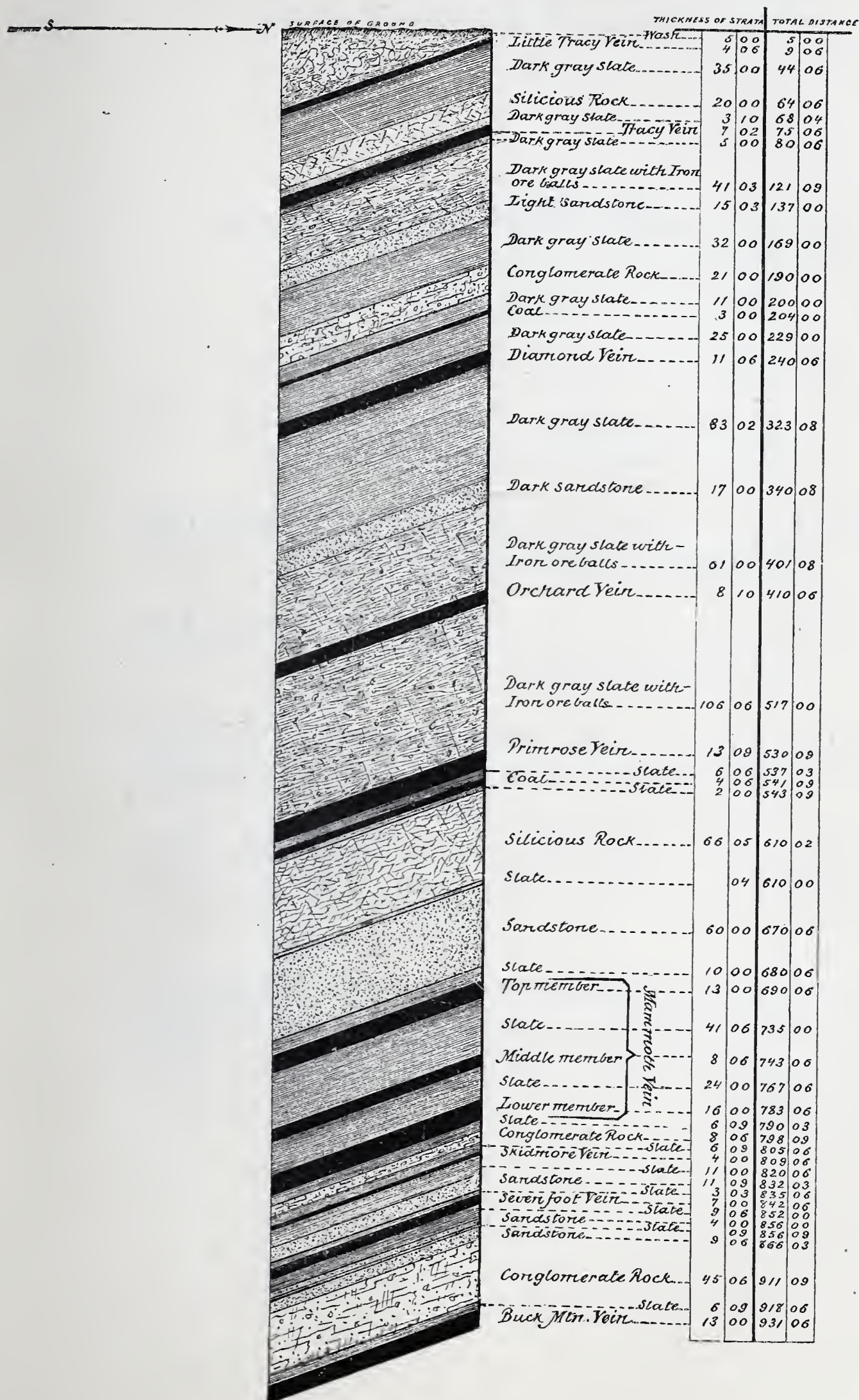


SCALE OF FEET





Philadelphia and Reading Coal and Iron Company.  
Geological Section near Ellangowan Colliery  
Schuylkill County Penna.



IN MINERAL ANNEX TO MAIN EXHIBITION BUILDING.  

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Exhibit  
marked

2440. COAL from the Mammoth Vein at the Knickerbocker Colliery ; weight of sample 23,000 pounds.

2445. MAP of the PHILADELPHIA AND READING RAILROAD and Branches.

2446. MAP of the COAL LATERALS of the Philadelphia and Reading Railroad.

2447. PLAN of the COAL WHARVES of the Philadelphia and Reading Railroad at Port Richmond, Philadelphia.

GEOLOGICAL SECTION near the Ellangowan Colliery, Schuylkill county, Pennsylvania. Scale, twenty feet to one inch.

GEOLOGICAL CROSS-SECTION of the anthracite coal veins contained in the Shenandoah, Ellangowan, and Mahanoy basins, Schuylkill county, Pennsylvania. Scale, two hundred feet to one inch.



## IN MACHINERY HALL.

## FAST FREIGHT ENGINE,

*Built by the Apprentices in the Company's shops at Reading, Pa.*

## GENERAL DIMENSIONS:

Cylinders, . . . . .	18 x 24 in.
Diameter of Driving-wheels, . . . . .	54 in.
Weight on Driving-wheels, . . . . .	53,536 lbs.
Diameter of Truck Wheels, . . . . .	30 in.
Wheel-base, . . . . .	20 ft. 5 in.
Diameter of Boiler, . . . . .	46 in.
Number of Tubes, . . . . .	198.
Length of Tubes, . . . . .	11 ft. 6 in.
Diameter of Tubes (outside), . . . . .	1 $\frac{3}{4}$ in.
Length of Fire-box, . . . . .	8 ft.
Width of Fire-box, . . . . .	3 ft. 6 in.
Heating surface of Fire-box, . . . . .	86 sq. ft.
Heating surface of Tubes, . . . . .	1041 sq. ft.
Total heating surface, . . . . .	1127 sq. ft.
Grate area, . . . . .	28 sq. ft.
Diameter of smoke-stack (inside), . . . . .	14 in.
Exhaust nozzle, variable, . . . . .	3 $\frac{3}{4}$ to 4 $\frac{3}{4}$ in.
Total weight of Engine, . . . . .	76,832 lbs.

## EXHIBIT IN GALLERY OF MAIN BUILDING.

## MODELS OF BRIDGES.

Model of FOREMAN TRUSS, single-track bridge, represents a bridge on Schuylkill and Susquehanna Branch of Philadelphia and Reading Railroad, being located six miles west of Pine Grove.

Scale of model, one inch to one foot.

Clear span of bridge, . . . . .	200 feet.
Width from out to out, . . . . .	19 feet 6 inches.
Height of truss, . . . . .	24 feet.
Height from water to bottom of rail, . . . . .	100 feet 4 inches.

The bottom chord is composed of six pieces of timber 6 inches by 15 inches, and the top chord six pieces 6 inches by 12 inches, with packing blocks notched in between each piece, securely fastened with rods passing through them. The structure is divided into fifteen panels, each 13 feet  $7\frac{3}{15}$  inches in length. There are six main and two counter braces; dimensions of braces in end panels  $6\frac{1}{2}$  inches by 10 inches, and decreasing to centre panel to  $6\frac{1}{2}$  inches by 8 inches. The iron was proportioned to carry a live load of  $1\frac{1}{2}$  tons per lineal foot. The rods are not subjected to a greater strain than 10,000 pounds per square inch. Weight of bridge, one ton per lineal foot.



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 IN GALLERY OF MAIN BUILDING.
 

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Model of FOREMAN PATENT ELLIPTICAL BOW-STRING BRIDGE, represents the standard over-grade bridge in use on the line of the Philadelphia and Reading Railroad and branches.

Scale,  $1\frac{1}{2}$  inches to 1 foot.

Clear span,	.	.	.	.	.	54 feet 6 inches.
Width from out to out,	.	.	.	.	.	16 feet.
Height of ellipse,	.	.	.	.	.	6 feet.

The top chord is composed of 9-inch I beams, and bottom chord of two flat plates  $\frac{1}{2}$  inch by 4 inches. Cast-iron vertical posts and diagonal tie-rods are used. Bridge is divided into fourteen panels, centre one being 5 feet in length, and decreasing in length toward the ends. Weight of bridge, one-quarter ton per lineal foot. Live load carried by bridge, one-half ton per lineal foot.

## DRAWINGS.

GROUND PLAN of Philadelphia and Reading Railroad Company's rolling-mill at Reading, Pa.

PLAN AND ELEVATIONS of puddling-furnace and boiler at the Philadelphia and Reading Railroad Company's rolling-mill.

PLAN AND ELEVATIONS of heating-furnace and boiler at the Philadelphia and Reading Railroad Company's rolling-mill.

## PHOTOGRAPHS.

North view of Philadelphia and Reading Railroad Company's rolling-mill.

South view of Philadelphia and Reading Railroad Company's rolling-mill.

## ANALYSIS OF COAL FROM LITTLE TRACY VEIN.

## FROM ELLANGOWAN COLLIERY.

Thickness of vein, 4 feet 6 inches.

No. 2431.—Volatile matter to 212°, . . . . .	1.96
“ “ to redness, . . . . .	3.24
Total, . . . . .	— 5.20 per cent.
Ash, . . . . .	8.30 “
Sulphur, . . . . .	0.128 “
Fixed carbon, . . . . .	86.372 “
Pounds of water evaporated by burning one pound of coal, 11.12.	

## ANALYSIS OF COAL FROM BIG TRACY VEIN.

## FROM ELLANGOWAN COLLIERY.

Thickness of vein, 7 feet 2 inches.

No. 2432.—Volatile matter to 212°, . . . . .	1.50
“ “ to redness, . . . . .	3.60
Total, . . . . .	— 5.10 per cent.
Ash, . . . . .	11.25 “
Sulphur, . . . . .	0.031 “
Fixed carbon, . . . . .	83.619 “
Pounds of water evaporated by burning one pound of coal, 11.70.	

## ANALYSIS OF COAL FROM DIAMOND VEIN.

## FROM ELLANGOWAN COLLIERY.

Thickness of vein, 11 feet 6 inches.

No. 2433.—Volatile matter to 212°, . . . . .	1.48
“ “ to redness, . . . . .	3.22
Total, . . . . .	— 4.70 per cent.
Ash, . . . . .	9.70 “
Sulphur, . . . . .	0.284 “
Fixed carbon, . . . . .	85.316 “
Pounds of water evaporated by burning one pound of coal, 8.82.	

## ANALYSIS OF COAL FROM ORCHARD VEIN.

## FROM ELLANGOWAN COLLIERY.

Thickness of vein, 8 feet 10 inches.

No. 2434.—Volatile matter to 212°,	. . . . .	1.92	
“ “ to redness,	. . . . .	3.48	
Total,	. . . . .	—	5.40 per cent.
Ash,	. . . . .	6.33	“
Sulphur,	. . . . .	0.238	“
Fixed carbon,	. . . . .	88.032	“

Pounds of water evaporated by burning one pound of coal, 10.34.

## ANALYSIS OF COAL FROM PRIMROSE VEIN.

## FROM KNICKERBOCKER COLLIERY.

Thickness of vein, 13 feet 9 inches.

No. 2435.—Volatile matter to 212°,	. . . . .	1.44	
“ “ to redness,	. . . . .	1.46	
Total,	. . . . .	—	2.90 per cent.
Ash,	. . . . .	3.36	“
Sulphur,	. . . . .	0.238	“
Fixed carbon,	. . . . .	93.502	“

Pounds of water evaporated by burning one pound of coal, 11.00.

## ANALYSIS OF COAL FROM MAMMOTH VEIN.

## FROM ELLANGOWAN COLLIERY.

Thickness of vein, 37 feet 6 inches.

No. 2436.—Volatile matter to 212°,	. . . . .	1.35	
“ “ to redness,	. . . . .	0.53	
Total,	. . . . .	—	1.88 per cent.
Ash,	. . . . .	1.90	“
Sulphur,	. . . . .	0.021	“
Fixed carbon,	. . . . .	96.199	“

Pounds of water evaporated by burning one pound of coal, 10.36.



ANALYSIS OF COAL FROM SKIDMORE VEIN.  
FROM NORTH MAHANOEY COLLIERY.

Thickness of vein, 4 feet.

No. 2437.—Volatile matter to 212°,	. . . . .	1.20	
“ “ to redness,	. . . . .	2.64	
Total,	. . . . .	—	3.84 per cent.
Ash,	. . . . .	6.25	“
Sulphur,	. . . . .	0.334	“
Fixed carbon,	. . . . .	89.576	“
Pounds of water evaporated by burning one pound of coal, 10.60.			

ANALYSIS OF COAL FROM “SEVEN-FOOT” VEIN.  
FROM NORTH MAHANOEY COLLIERY.

Thickness of vein, 7 feet.

No. 2438.—Volatile matter to 210°,	. . . . .	1.25	
“ “ to redness,	. . . . .	1.41	
Total,	. . . . .	—	2.66 per cent.
Ash,	. . . . .	6.02	“
Sulphur,	. . . . .	0.334	“
Fixed carbon,	. . . . .	90.986	“
Pounds of water evaporated by burning one pound of coal, 10.40.			

ANALYSIS OF COAL FROM BUCK MOUNTAIN  
VEIN.  
FROM WEST SHENANDOAH COLLIERY.

Thickness of vein, 13 feet.

No. 2439.—Volatile matter to 212°,	. . . . .	1.02	
“ “ to redness,	. . . . .	2.97	
Total,	. . . . .	—	3.99 per cent.
Ash,	. . . . .	7.20	“
Sulphur,	. . . . .	0.663	“
Fixed carbon,	. . . . .	88.147	“
Pounds of water evaporated by burning one pound of coal, 10.10.			



ANALYSIS OF COAL FROM THE LOCUST SPRING COLLIERY.

(No. 259.)

MAMMOTH VEIN.

(Averaged by benches—whole thickness represented.)

ANALYSIS NO.	921	922	923	924	925	926	AVERAGE OF VEIN.	EXCLUDING TOP BENCH.
Volatile matter to 212°.....	1.10	1.16	1.08	1.45	1.63	1.69	1.29	1.24
“ “ “ Redness..	3.43	0.61	1.89	0.90	3.10	12.06	3.40	2.14
“ “ “ Total.....	4.53	1.77	2.97	2.35	4.73	13.75	4.69	3.38
Ash.....	3.26	5.42	8.50	3.95	3.75	8.17	5.34	4.98
Sulphur.....	0.15	0.22	0.20	0.14	0.24	1.19	0.32	0.19
Fixed carbon.....	92.05	92.58	88.33	93.55	91.27	76.88	89.65	91.45
Heating power.....	10.56	11.77	10.67	10.23	9.90	10.78	10.69	10.67
Thickness.....	4' 3''	3' 1/2''	3' 2''	2'	2' 6''	2' 2''	17 ft. 1 1/2 in.	14' 11 1/2''

14 11 1/2  
= 172.5

“ANTHRACITE is the most condensed form of mineral coal and the richest in carbon. Its color varies from jet and glistening black to dark lead-gray.”

“It gives an intense concentrated heat.”

The amount of carbon in American anthracite varies from eighty to ninety-five per cent., and it contains much less sulphur than the semi-bituminous or bituminous coals.

Anthracite coal, when suddenly exposed to a high temperature, decrepitates or chips off in small flakes from the surface of the mass or lump. It produces a flame only when the hot carbonic acid at first formed, by combustion in an insufficient supply of air, is brought in contact with fresh air and burned to carbonic acid. The general division of anthracite is into white-ash and red-ash coals; the white-ash comprising the harder and the red-ash the softer varieties.

For furnace use preference is generally given to white-ash coals and those of the harder sort, capable of carrying the greatest weight. The enlarged knowledge of the present day as to the comparative values of carbon and of hydrogen as sources of intensity and of volume of heat, secures the most economical selection of coal for purposes in which intensity or volume of heat may be necessary. For smelting purposes a certain intensity is absolutely necessary, whilst for steam or household use great volume is desirable.

To a degree, volume of heat is appropriate for furnace work, to replace the heat lost by radiation; but at the same time a high temperature must be secured to insure proper chemical combinations of ore and flux, and the fluidity of the results of combination and the metal eliminated.

Red-ash coals contain a percentage of oxide of iron, which gives a red color to the ash. They are more easily kindled and burn more freely than the white-ash coals, but are more liable to produce a clinker. For this reason they are not so well adapted

for purposes which require a strong draft. Their especial adaptation is for the production of steam in large flue or cylindrical boilers and general household use for stoves and open grates.

For steam purposes the essential for tubular or high-draft boilers is the non-formation of clinker, and for low-draft boilers and household use, heat of great volume, with absence of a large percentage of ash.

For tubular boilers and those with strong draft a moderate percentage of (not over fifteen or eighteen per cent.) voluminous pulverulent ash is of great advantage. Such an ash is to a great extent conveyed from the furnace by the draft and carries with it a large amount of heat, which it gives out by contact with the flues much more efficiently than do the hot gases. It is often found economical to select a coal yielding a less volume of heat and such an ash, rather than one of greater heating power with less ash, or an ash that forms a clinker in the furnace.

A comparison of the relative values of anthracite from the several mining regions shows that the coals mined in Schuylkill county are of equal value for all and superior to most others for many purposes of the arts and are as free from impurities, as any that are sent to market.

The soft coals of the Schuylkill region surpass any of the semi-bituminous and approach many of the bituminous coals in heating power, and their greater freedom from sulphur and phosphorus render them particularly suited to the purposes of the arts where these ingredients may be prejudicial.

These coals, when fairly ignited, should not be greatly disturbed, but burn best when permitted to remain quietly in the furnace. Decrepitation does not interfere with any of the uses to which anthracite is applicable, and the coal is not subjected to any preparatory process or treatment before being used for heating or smelting purposes. Any boiler with extended fire surface can



be used economically with anthracite. The heat from anthracite is best got from the direct or radiant rays, and a large fire surface, with boiler surface directly exposed to it, is more economical than a small fire and enlarged flue and other absorbing surface. The thickness of fuel upon the grate should be restricted to that which can be kept uniformly covered, without burning into holes, through which air can readily pass, say from three to nine inches, depending somewhat upon the size of the fuel.

The smokeless fire produced from anthracite has many advantages over that from the bituminous and semi-bituminous fuels, not only for use for war steamers, but for use in cities generally.

Its greater density permits a larger weight of fuel to be stored in small space, and its absolute freedom from spontaneous combustion permits of its storage for any desirable length of time.

These anthracites are extensively used in smelting-furnaces, puddling-furnaces, heating-furnaces, household ranges, stoves, open grates, limekilns, brick kilns, stationary steam-boilers, locomotives, ocean steamers, and in fact for every purpose to which ordinary soft coals are applicable.

The collieries of the Philadelphia and Reading Coal and Iron Company cover a large territory, in which are found coals exactly suited to all of the wants of commerce and manufactures, comprising those of the hard white ash and soft red ash, with all the intermediate grades.